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Governing the Southern Ocean: The science-policy interface as thorny issue

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ABSTRACT

The Southern Ocean is a unique ecosystem with highly coveted marine resources. It includes the largest marine protected area anywhere, with management spread across national jurisdictions and a number of international bodies and cooperative arrangements. The area has local, national and international stakeholders with interests in an array of activities, such as fishing, tourism and scientific research. This article sheds light on the linkages between climate change and governance of Southern Ocean marine territories. It unravels the complexity of governing this marine region, in the process looking at biodiversity conservation, exploitation of resources and military activities. Using socio-historic analysis and ethnographic observation, it examines multiple decision-making areas, institutions, groups and actors. Issues examined in this artice include marine protected areas, fisheries management and environmental impacts of melting Antarctic ice and French subantarctic territories. These issues are viewed through the prisms of knowledge and policy – a knowledge-policy interface. Case studies highlight the interactions between human activities and climate change in Southern Ocean ecosystems. Real-world examples illustrate the governance of marine ecosystems and resources and demonstrate adaptations to environmental changes already affecting sub-Antarctic societies.

1. Introduction

Antarctica is often described as a largely pristine environment. It is one of the planet's last wildernesses with no permanent human settlements apart from a scientific presence and an emerging tourism. The environment of the polar continent makes it especially appealing for scientists. Indeed, the Protocol on Environmental Protection to the Antarctic Treaty signed in Madrid in 1991 has designated Antarctica as a "natural reserve, devoted to peace and science" (art.2). While the Protocol accords "priority to scientific research" (art.3.3), it is possible to organize other activities, such as fishing, tourism and non-governmental activities. The "key selling points of Antarctica and other remote areas are their pristine wilderness, unique and undisturbed wildlife, and dramatic landscapes" (Haase et al., 2009). While Antarctica is often thought of as an environment little affected by human disturbance, the area is no longer as pristine as it used to be due. Some examples can be given: the over exploitation of some marine species, anthropogenic climate change, alien species pressure, local production and the long-distance transportation of pollutants and their very slow degradation in polar conditions (Znój et al., 2017). Moreover, as elsewhere in the world, natural sciences researchers have shown that this area has been altered by climate change. Regional warming and ocean acidification have, for example, led to immediate conservation threats to some species, ecosystems and resources in Antarctica (Chown et al., 2012). While reasonably broad estimates can be made as to "how quantities such as temperature, precipitation, acidification of the ocean and sea ice extent might change", the situation is not quite so clear-cut when it comes to the reactions of Antarctica's large ice sheets (Turner and Barrand, 2014). Environmental changes will also have consequences for logistics, mainly regarding access and operations in the area (Liggett et al., 2017). Compared to other regions, however, the significance and diversity of human activities in Antarctica is minimal.

There is large heterogeneity in terms of the actors and targets in this domain, and, at the very least, minimal cooperation between the actors

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is essential. The Scientific Committee on Antarctic Research (SCAR), which is an inter-disciplinary committee of the International Council for Science, has recognized the Antarctic Treaty System and thus the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) (Canberra, 1980) as "international initiatives and organizations". Indeed, they limit the exploitation of natural resources, industry and fishing and their resulting anthropogenic impacts. SCAR recognizes that the main direct influences on Antarctica are "likely to come from global climate change in the mid to long term" (Turner and Bindschadler, 2009).

Antarctica is recognized for its environmental singularity and renowned for its governance arrangements. The remoteness of Antarctica in relation to centres of human activity has contributed to the development of a specific governance system for the region, which is based on the Antarctic Treaty (Antarctic Treaty, 1959). The Southern Ocean, characterized by the presence of Antarctica with its unique international status, is directly faced with global change. This article tries to explain how the governance of this specific socio-ecosystem and its highly coveted marine resources is implemented through different mechanisms with different stakeholders involved at different levels. This normative vision from a legal and sociological point of view raises the question of the social construction of the *sui generis* so-called "governance" of Antarctica. In the context of climate change impacting Antarctica, how does the decision-making process take place, and which actors take part in or are excluded from this process? In relation to the announcement of a "planetary governance", which derives from the concept of "planetary common goods" (that is, goods not subject to the sole sovereignty of any nation (Buck, 1998; Ostrom, 1990; Ostrom, 2010), the construction of the boundaries of planetary common goods like Antarctica involves processes of inclusion and exclusion at the definition stage and results in the creation of international associations that raise equity issues on a global scale (Pflieger, 2014). How then are science and the decisions taken linked in this decision-making process concerning the "governance" of the Antarctica region? In responding to this question, we will be contributing to the literature on the socio-ecological system model. There has been very little research conducted on the science/policy interface in this domain, particularly in regarding to climate change adaptation governance (Vink et al., 2013), and the role and mechanism of power needs to be more broadly investigated (Olsson et al., 2014). Antarctic activities pose a "unique governance challenge" since the region is "not controlled by any single sovereign State" (Student et al., 2016). Operationally, the Antarctic Treaty System (ATS) has established an exceptional collective responsibility whereby any issue arising in Antarctica is the responsibility of the Antarctic Treaty Consultative Parties (ATCP). The aim of this paper is to explain how Antarctica is governed, or managed, at the science/policy interface. This international cooperation on Antarctica benefits both humankind and environmental protection.

2. Cooperation for the benefit of humankind

Nearly 60 years after it was signed, the Antarctic Treaty "remains the cornerstone of Antarctic governance" (Dodds, 2010). This international cooperation for the benefit of humankind was developed following the recognition of the region as a territorial exception, and it contributes to a collective responsibility for the management of Antarctica.

2.1. The recognition of a territorial exception

The acquisition of "ownerless territories" has been the goal of many maritime expeditions to distant lands. In all, seven States have seen, in the discovery of Antarctica, a means of asserting their sovereignty away from their metropolitan territory (Argentina, Australia, Chile, France, New Zealand, Norway, United Kingdom) (Dupuy, 1958). They have based their territorial claims on an assortment of arguments, such as discovery, geographic proximity and acts of sovereignty. The assertion of sovereignty rights over part of the Southern continent is fraught with consequences because of risks of jurisdiction conflicts. Not only the claims have not been globally recognized, but there is an overlapping of the claims of Argentina, Chile and the United Kingdom and Marie Byrd Land (between 90 °W and 150 °W) has not been claimed.

The scientific value of Antarctica has led States to cooperate. Researchers quickly realized the importance of combining Antarctica with peaceful purposes and international cooperation, and their initiative resulted in the third International Geophysical Year (IGY) (1957–1958), creating "uncommon collaborations and unprecedented results" (Belanger, 2004). The accomplishment of numerous scientific programmes during the IGY "facilitated the resolution of long-standing sovereignty disputes in the signing of the Antarctic Treaty" (Powell, 2008) in 1959 by the claimant States and five other States (Belgium, Japan, South Africa, the Soviet Union and the United States). A "status quo concept" (Hayton, 1960) was established in article IV of the Treaty, which recognizes all positions. This clause, "which is intended to preserve the conflicting interests of claimant states, potential claimants, and non-claimants" (Triggs, 1985) is "critical to the success of the Antarctic legal regime". Human activities are "collectively governed" by the Antarctic Member States and the ATS (Lamers et al., 2012).

The ATS area covers the region "south of 60 °South Latitude" (art. 6 of Antarctic Treaty, 1959), with the exception of the CCAMLR. The expansion of krill harvesting in the mid-1970 s has shown how important conservation is for the maintenance of Antarctic marine life (Parkes, 2000). The food chain means that birds, marine mammals and fish are all highly dependent on krill. Through collaboration, scientists have convinced States to delimit the CCAMLR through Antarctic Convergence (art.1.4 of the Convention on the conservation of Antarctic Marine living resources, 1980). The whole Southern Ocean area surrounding the continent of Antarctica is covered. As such, it concerns some islands that are subject to sovereignty (for example, the Bouvet island is a dependency of Norway and the Crozet and Kerguelen islands are French territories). A statement by the Chairman of the Conference, appended to the Final Act of the Conference, sets out a system that functions by exception for "the waters adjacent to Kerguelen and Crozet over which France has jurisdiction and to waters adjacent to other islands within the area to which this Convention applies over which the existence of State sovereignty is recognized by all Contracting Parties". Such a regime reduces the scope of the ecosystem approach by creating exemptions in the implementation of conservation measures (Cordonnery, 1998).

Divergent interests always create a challenge for long-term planning cooperation. Hence, "convinced that the establishment of a firm foundation for the continuation and development of such cooperation on the basis of freedom of scientific investigation in Antarctica as applied during the International Geophysical Year accords with the interests of science and the progress of all mankind" (Antarctic Treaty preamble), the Antarctic Treaty has established a collective responsibility for Antarctic management.

2.2. Collective responsibility for antarctic management

The ATCP have taken "collective responsibility for Antarctic arrangements" (Hemmings, 2016) based on the "interest of all mankind". In the Preamble to the Antarctic Treaty, it is recognized "that it is in the interest of all mankind that Antarctica shall continue forever to be used exclusively for peaceful purposes". According to the ATS documents, "the ATCP had and continue to have a collective ambition to manage Antarctica" in the interests of all humankind (Bastmeijer and Tin, 2014). On the 50th anniversary of the Antarctic Treaty, the ATCP pledged "to continue and extend for the benefit of all humankind their cooperation established in the Treaty" (ATCM XXXII Washington Ministerial Declaration, 2009), and other member States were "urged to" adhere to the Madrid Protocol (Beck, 2017).

The ATCP have continued to implement the commitments set out in the Treaty, focusing mainly on environmental protection of the region and the development of science by on-site scientists. Cooperation is generally regarded as the "raison d'être" of the Antarctic Treaty. The authors of the Madrid Protocol have not questioned the system of governance they inherited. The States have organized a co-administration between them within the Antarctic Treaty Consultative Meetings (ATCMs). While the ATCMs are open to all Antarctic Treaty Member States, not all of them have the same powers. The ATCP occupy a special place among them. The 12 Contracting Parties referred to in the Antarctic Treaty preamble have subsequently been joined by 17 States, which acquired ATCP status by co-option. To be recognized as an ATCP, a Member State that is not one of the 12 initial Contractive Parties has to demonstrate "its interest in Antarctica by conducting substantial scientific research activity" through, for example, the "establishment of a scientific station" or "the dispatch of a scientific expedition" (art.9.2 of the Antarctic Treaty, 1959). More recently, it was decided that the applicant must be a Madrid Protocol Member State (art.22.4 of the Protocol, 1991) and must have approved all effective Annexes to the Protocol (Decision, 2005). The Guidelines on the procedure to be followed with respect to Consultative Party status are annexed to (Decision 2, 2017).

"Since Antarctic is not the subject of undisputed state sovereignty, the legal protection of the Antarctic environment depends on the collective efforts" (Abdullah et al., 2015). The ATCMs are a "multidimensional forum that have allowed for the constant advancement" of the ATS and "for everything from the exchange of points of view to negotiations on binding instruments" (Lamus, 2013). Their main purpose is to monitor the implementation of the ATS. Among other things, the ATCP can adopt decisions regarding the "use of Antarctica for peaceful purposes", the "facilitation" of scientific research and international scientific cooperation in Antarctica and the preservation and conservation of living resources in Antarctica (art.9.1 of the Antarctic Treaty, 1959). They can also adopt recommendations for the "implementation" of the Madrid Protocol and define "the general policy for the comprehensive protection of the Antarctic environment and dependent and associated ecosystems" (art.10.1 of the Madrid Protocol, 1991). The Measures, Decisions and Resolutions, as referred to in (Decision 1, 1995), are adopted by consensus, and a single State can block all decision-processes.

The Madrid Protocol "provides strict guidelines" for the Antarctic environment and underscores its value to scientific research. Although rigorous application of the Protocol helps minimize, for example, the local impacts of both the tourism industry and national Antarctic Programs constant vigilance is necessary (Turner and Bindschadler, 2009). Hence, interactions with other actors are essential and even more for protecting the marine environment.

3. Interaction in protecting the marine environment

The ATCP remain the forum for discussion and decision-making and are the diplomatic-legal reference for Antarctica due to their cooperation with scientific and technical expertise and their interaction in protecting the marine environment.

3.1. Cooperation with other international organizations

Reaffirming the "conservation principles of the CCAMLR" and willing to "prevent, reduce and respond to pollution of the Antarctic marine environment" (preamble and art.13 of Annex 4 to the Madrid Protocol, 1991), the ATCMs have strengthened interaction with other organizations in the protection of the marine environment.

The CCAMLR is responsible for the management of marine living resources in the Antarctic and is charged with adopting the Agreed Measures for the Conservation of Antarctic Fauna and Flora based on the reports of the Scientific Committee. The CCAMLR is thus a "global leader in its practical implementation of precautionary and ecosystem-based management" (Miller et al., 2004).

While the ATCMs and the CCAMLR adopt an independent approach to the issue of marine areas, they nevertheless have a duty to collaborate. This cooperation is carried out through ongoing liaisons between the various bodies of the ATS and the organizations involved, including SCAR. There is a general desire for cohesion and coordination among the components of the ATS. Marine-protected areas can be considered as a way of protecting marine ecosystems from human activities. No marine area receives the Antarctic Specially Protected Areas and Antarctic Specially Managed Areas designation without the prior approval of the CCAMLR (art.6.2 of Annex V of the CCAMLR, 1980). A resolution from the CCAMLR Commission to adopt a management plan for a CCAMLR Ecosystem Monitoring Programme (CEMP) site also needs to be transmitted to SCAR and the ATCMs (CCAMLR Conservation Measure, 91-01 [2004]). A new Marine Protected Area was, for example, agreed in 2016 for the Ross Sea (CCAMLR Conservation Measure, 91-05, 2016).

While some areas require a specific approach, a comprehensive approach also merits attention, particularly in terms of marine pollution. The increase in the number and size of vessels operating in the Antarctic leads to an increased risk of accidents. The States have realized the importance of developing mandatory legal instruments to ensure not only the safety of maritime activities in ice-covered waters but also environmental protection. The International Maritime Organization (IMO) is undoubtedly the organization to regulate navigation. With the IMO's drafting of an International Code of Safety for Ships in Polar Waters (the Polar Code), the ATCMs have recognized the benefits of introducing a similar code for vessels operating in Antarctica. In the hope that the IMO Guidelines for ships operating in the Arctic ice-covered waters will be amended and applied specifically to ships in ice-covered waters in the ATS area, the ATCMs have chosen to adapt the guidelines themselves for navigation in the waters of the Southern area (Decision 4, 2005). There has been a successful extension of the voluntary Polar Code into a mandatory instrument under the International Convention for the Safety of Life at Sea (SOLAS) and the International Convention for the Prevention of Pollution from Ships (MARPOL), which also covers Antarctica. The Polar Code and SOLAS amendments were adopted in November 2014 (during the 94th session of the IMO's Maritime Safety Committee), and the environmental provisions and MARPOL amendments were adopted in May 2015 (during the 68th session of the Marine Environment Protection Committee). The Polar Code entered into force in January 2017. It is particularly significant because the IMO regulations "can reach a broader membership", including third States in Antarctica (Weber et al., 2014). An effective implementation of the Polar code is now expected.

3.2. Cooperation with scientific and technical expertise

To assist the ATCMs in their "substantive work", experts from international organizations with a "scientific or technical interest in Antarctica" may also, at the invitation of the ATCP, attend the ATCMs (Rule 39 of the Revised Rules of Procedure for the ATCM, 2016). SCAR, the Commission of the CCAMLR and the Council of Managers of National Antarctic Programs retain a special position and area allowed to participate at the meetings (Rule 31 of the Revised Rulesfor the Committee for Environmental Protection, 2011). With the Madrid Protocol, SCAR is often asked by the ATCMs as well as the Committee for Environmental Protection (CEP),[1] "to provide advice on specific scientific/technical issues" relating not only to the implementation of the Madrid Protocol but also to international scientific cooperation in

[1] Committee for Environmental Protection should not be mistaken with the French Polar Environment Committee also named CEP (for Comité de l'Environnement Polaire).

Antarctica (Hemmings, 2010). Over the years, a "strong and productive working relationship" has been forged between SCAR and the ATCMs (Zumberge, 1987). Decisions are thus scientifically underpinned. In 2009, for example, SCAR decided to review the current understanding of the physical and chemical climate system of the Antarctic area (Turner and Bindschadler, 2009). SCAR provides the ATCP with annual updates to its Antarctic Climate Change report (Scientific Committee on Antarctic Research Annual Report 2016 - 2017 to Antarctic Treaty Consultative Meeting XL, 2017).

Several institutions have also been established to assist Member States to implement treaties. One of the key institutional components of the CCAMLR is the Scientific Committee. This consultative body (art.14 of the CCAMLR, 1980) advises the Commission based on the best scientific information available. The Madrid Protocol has created the CEP (art.11of the Madrid Protocol, 1991). Acting as an advisory body to the ATCMs, it remains subordinate, reporting to them on each of its meetings (Rule 12, Revised Rules of Procedure for the CEP, 2011). As part of its duties, it also consults SCAR, the Scientific Committee of the CCAMLR and other appropriate scientific, environmental and technical organizations (art.11.2–4 of the Madrid Protocol, 1991). The CEP has no executive or political role. It is solely responsible for providing opinions on environmental issues to the ATCMs. Although it is not required to conduct any Environmental Impact Assessments or Comprehensive Environmental Evaluations, it does undertake "post-analysis" in order to formulate its recommendations (Cordonnery, 1999). The CEP is a "highly relevant and important component of the ATS" because of its flexibility in "addressing new issues" and its practical tools for environmental management (Sánchez and McIvor, 2007). Moreover, since the Madrid Protocol, policy development has not been rapid, but it has led to "influential successes" driven "predominantly, by interested individuals within the CEP and SCAR" (Hughes and Pertierra, 2016).

Cooperation between these different bodies is only valuable if it is based on internationally recognized scientific expertise. Each State tries to contribute to this expertise. As such, long-term ecological research (LTER) is productive and even becomes more productive with international cooperation

3.3. Social-ecological research as interface between science, policy and environmental management

The Antarctic and sub-Antarctic areas are very sensitive to current climate change. For appropriate management measures to be adopted, an "in-depth understanding of ecosystem structures, mechanisms and processes" is needed. This is one of the "core objectives of long-term ecological research" (Haase and Frenzel, 2016). The United States LTER programme, which was initiated in 1980 "through funding from the National Science Foundation" (Michener and Porter, 2011), has organized interdisciplinary polar marine research in Antarctica (Palmer Station Antarctica LTER, McMurdo Dry ValleysLTER). LTER sites are "dedicated to documenting, analysing, and understanding ecological processes and patterns operating over long time scales and broad spatial scales" (Redman et al., 2004). LTER represents a "particular kind of setting for data stewardship, characterized and challenged by a long-term science perspective coupled with an open data sharing policy of primary research data in a highly distributed environment of interdisciplinary collaboration" (Karasti et al., 2006).

A comparison between the international governance of Antarctica and national policies in all sub-Antarctic islands (for example Heard Island, Marion and Prince Edward islands, Bouvet island) could be organised. Such a comparison presents certain interest and would deserve a follow-up study to the one that we led. Keeping this comparative approach for a next stage, we have here decided to focus on the French sub-Antarctic islands and more precisely the Crozet archipelago and the Kerguelen islands which belong to the CCAMLR area. The reasons are that a French Antarctic and sub-Antarctic LTSER exists and the administrative management of the sub-Antarctic islands is specific to each State.

In France, the LTER mechanism has been supported by the National Centre for Scientific Research (CNRS) since 2000. There are fourteen "zones-ateliers" (ZA) on the French territory (metropolitan and overseas) dedicated to large rivers, mountainous areas, cities, agricultural plains or the land-ocean interface. It is the so-called network of French "zones-ateliers" (ZA) which is presently becoming LTSER network, including more and more the social component of the social-ecological system concept (Bretagnolle et al., 2018). Its objectives are to create a collective and innovative interdisciplinary research dynamic, in close touch with stakeholders and decision makers (Jollivet, 2001).

Known as ZATA (Zone Atelier Antarctique et sub-Antarctique), the French Antarctic and sub-Antarctic LTSER is focus on Antarctica (Adelie Land) and in the Southern Ocean including the French sub-Antarctic islands (Crozet, Kerguelen, Saint-Paul and Amsterdam islands). Following a long and strong relationship between scientists, the French Polar Institute (IPEV) and the TAAF, especially for logistics[2] the LTER French Southern islands was created in 2000. This setting can be considered as "sentinels" in the face of global environmental changes (climate, invasive species, etc.) and privileged situations for the study of these issues. The scientists involved in ZATA work in close interaction with the public administration in charge of the French Antarctic and sub-Antarctic Territories (Terres Australes et Antarctiques Françaises – TAAF) whose legal status is unique in France and the principle of legislative speciality apply to it.

TAAF is an overseas administrative territory with a moral personality and a financial and administrative autonomy that was created in 1955 (French law n°55-1052, 1955). Thus, TAAF[3] are administrated by a prefect high commissioner, representing the French State. Moreover, it is an Overseas Countries and Territories (OCTs) so it is not member of the European Union. It is the only uninhabited French overseas territory whose dominant activity is scientific research. For the past half a century, environmental observation has been continuously carried out in the French sub-Antarctic islands and in Adélie Land from the perspective of different disciplines. ZATA relies on research programmes supported by the French Polar Institute. Its research sites are dedicated to the long-term monitoring of changes in organisms, populations and ecosystems in terrestrial and marine environments due to the combined impact of human activities and climate change. ZATA's thematic considers the biological communities being studied, which were hitherto isolated, are subject to increasing anthropic pressure both on land and at sea and that they are highly sensitive to current climate change. ZATA develops and supports the networks of long-term observation on polar biodiversity based on the premises of LTER.

In Antarctic, there is a general and international coordination of research carried out by SCAR. SCAR also oversees useful action groups, such as ANTOS (Antarctic Nearshore and Terrestrial Observation System). Many ZATA members participate in international programmes and sit as experts on international committees like the CEP and the CCAMLR Scientific Committee, thus ensuring permanent contact with the international community. There is an active network operation, which aims to mutualize methodologies (modelling, systems information, interoperability of databases), take on shared scientific issues and lead prospective reflections (Lagadeuc and Chenorkian, 2009). Scientific data collected under the umbrella of the ZATA network are incorporated into international databases. Some data also come under the aegis of SCAR (for example, the EBA [Evolution and Biodiversity in the Antarctic] and SCAR-MarBIN [Marine Biodiversity Information Network]).

[2] IPEV supports and implements research programs in Antarctica and Subantarctic islands, following assessment by its Council for Polar Science and Technology Programs. TAAF administration supports research with logistical materials as, for example, ships and research stations or camps on sites.

[3] TAAF as territory includes 5 districts: 3 sub-Aantarctics (Kerguelen, Crozet, Amsterdam and Saint-Paul), 1 polar (Adélie Land) and since 2007, 1 tropical (Eparses islands).

The French LTERs are in direct contact with the actors in this territory and particularly with questions from managers, policies and associations. Because of the diversity and complementarity of their skills, ZATA members are thus the interlocutors of choice for various bodies associated with environmental management and conservation issues. “TAAF regulations therefore mostly aim to provide a better framework for human activities based on up-to-date scientific knowledge” (Quétel and Marinesque, 2016, box 1). A National Nature Reserve of the French Southern Lands was, for example, set up in 2006 (French Decree n°2006-1211) and extended in 2016 (French Decree n°, 2016-1700). Within this Reserve, the authorities try to reconcile the need for biodiversity conservation and for continued exploitation of the natural resources (mostly fisheries), scientific activities and tourism.

The CNRS SPA project (Savoir, Pouvoir, Avoir – Knowledge, Power, Owning) explores relations between knowledge, the environmental management and policies and the economy. It combines the tools of social sciences of politics, natural sciences and engineering to understand the advances and bottlenecks in terms of the sustainable management of coastal and marine social-ecological systems (Mazé et al., 2017). There are three study sites: Saint-Pierre and Miquelon (Mazé et al. (2019)), the French LTsER Brest Iroise (ZABrI, Ragueneau et al., 2018 and Mazé et al., 2018) and the ZATA. The first results of the study on the National Nature reserve of the French Southern Lands management prove the importance of the cooperation between scientists and the administration for a sustainable management. First at all, a scientific group wrote in 1996 a report asking for the case in National Nature Reserve of the French sub-Antarctic islands (Jouventin et al., 1996). The French government took this report back for the creation of the reserve in 2006. Different obstacles will lead to a long gestation of the project. This is due in particularly to the immaturity of the legal regime, the institutional particularity of the territory, the extent of the reserve with a part at sea and the specificity of the southern lands (Sombetzki-Lengagne, 2003).

Created by French Decree of 1993 (French Decret n°93-740) the French Polar Environment Committee constitutes the scientific committee of the reserve (article 4 of the French Decree, 2006). This committee is composed of a President and ten personalities chosen for their competence in the field of scientific and technological activities and in the field of the environment (French Ministerial Order, 2017; article D 133-32 of the French Environmental Code, 2001). This committee is, consequently, mainly composed of members who have recognized scientific competences or are scientists involved in the polar research named by the French Ministry of ecological transition and solidarity. This scientific committee is to be consulted on the management plan and on every scientific issue relating to environment (Lebouvier and Frénot, 2007). Before the final decision taken by ministerial Decree, some scientists had consequently been consulted for the extension of the reserve in 2016. Moreover, the conservation of these areas by the reserve direction under the supervision of the prefect does not prevent the continuity of the scientific research in these lands if previously authorized. Indeed, scientific activities contribute not only to fundamental science but also to improve biodiversity knowledge to help conservation. However, some tightness happens between scientific actors and TAAF administration. Before the IPEV creation in 1992, scientific research was directed by the Research Mission within the TAAF administration. This separation caused an ambiguity on both organizations competences, particularly for logistic of the scientific expeditions (Cour des comptes, 2014). Moreover, the research impacts are not estimated in the same proportions by both. Some experiments need an endorsement of the prefect after opinion of the reserve direction to be executed, asking more administrative work for the scientists. For example, the reserve includes strictly protected areas where scientists need an authorization to go in there. The risk is to have a scientific program which could be accepted for its scientific values by IPEV which could be not accepted by the TAAF administration for environmental reasons. Therefore, the research management by the reserve direction could be seen, for scientists, as prejudicial for their research. A permanent compromise must be found between conservation and the sub-Antarctic research improvement, and this is even genuine when scientific activities contributes to study environmental consequences of human activities.

4. Conclusion

In conclusion, we would like to return to the concrete implications of the Treaties and of the link between science and policy in the governance of the Antarctica region. The ATCMs have frequently declared their collective ambition to manage Antarctica for the benefit of all humankind. The main challenge in terms of gaining a better understanding of the decision-making processes and of the regime of governance of the Antarctica region now leads us to strengthen input from sciences (Hughes et al., 2018), and specifically the human and social sciences. Different international research programmes have asked people from different parts of the world to reveal their representations of Antarctica to understand its values and the way in which it should be managed (see SCAR Antarctic Humanities & Social Sciences EG). Introducing this point of view into the research on Antarctica governance allows us to gain some additional perspective as compared with the normative vision of the “governance” of Antarctica, not in legal but in sociological terms. In parallel an increasing number of countries are striving to strengthen their position in Antarctica, whose territory offers great strategic and commercial potential through the exploitation of its resources. The days of European, Australasian and North American domination are gone. The geopolitical struggle is now played out in Antarctica (Dodds and Nuttall, 2016). Until now, the climate change, and in particular melting ice and iceberg recession, that affects this polar region is hardly used for economic purposes, the institutions of governance content to ensure the study and monitoring through various scientific research devices in progress, but the pressures of some countries are growing stronger (essentially for access and exploitation of resources, generating territorial and geopolitical tensions). The governance of the Antarctic is therefore unique in the world, thanks to a system for the benefit of humankind, but global change strongly impacts the relations of the different parties, and thus indirectly the taking of positions in governance. But the organization we know still allows a governance adapted to the context of global change, thanks to its specificities, notably thanks to the strong use of scientific research, which is a unique example in the world of science / policy cooperation.

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